Column 419

little ground squirrels help answer BIG questions

by **Erling Friis-Baastad**

While not everyone agrees on the causes or the long-term effects of global warming, it's obvious to all that the sub-arctic ecosystem is undergoing dramatic change.

Meanwhile, paleontologists are chipping away at some of our uncertainty. By traveling back in time they are accumulating ideas about what living organisms in the North may be up against over the coming years.

A Pleistocene ground squirrel skull emerges from the permafrost. (photo: Grant Zazula)

An energetic guide on their journey back into the Pleistocene is *Spermophilus parryi*, better known as the arctic ground squirrel.

While the mammoth tusks and bison horns unearthed by Klondike placer miners have garnered more popular attention, the miners have also been uncovering fossilized ground squirrel nests while digging into the permafrost.

Secreted in the nests -- which at first appear to be solid balls of hay, about 30 centimetres wide and high -- are precious clues as to how dramatic environmental change affects ecosystems.

"The placer miners essentially rip away frozen sediments and expose these amazing records of past environments and environmental change," says Grant Zazula, a paleoecologist who is about to begin his fourth summer working in the Klondike.

The miners are excavating soils laid down during the Pleistocene ice ages. Back then, thanks in part to its dry climate, a region of Alaska and central Yukon known as Beringia Refugium remained free of the great ice sheets.

Here mammoths, short-faced bears, horses and steppe bison had room to roam and thrive.

Underfoot energetic little ground squirrels spent their short summers foraging for

fruits, seeds and leaves for their caches so they would have something to feast on after a long winter's hibernation.

Not surprisingly, the males who were able to "pork out" the most before emerging into the spring sun and all-too-short mating season had the best chance of reproducing, says Zazula.

"Within the permafrost in the Klondike we find the nests they slept in and the food caches that were collected in the fall."

"They were supposed to be eaten in the spring but possibly they were left behind because the squirrel died, or possibly had eaten enough and didn't need anymore."

Zazula had heard about these nests, and the treasures they contained while "wrestling with topics" for his PhD dissertation. He was also aware of work done by researchers in the American Southwest, where pack-rat nests had been preserved for millennia in dry caves.

"When they started examining those fossil nests, they realized that some of the plants found in the nests aren't found in the region today, suggesting that those fossils could provide an interesting record of past environmental change."

It dawned on the scientist that it was possible to employ similar techniques using arctic ground squirrel nests and middens from these permafrost areas in the Yukon.

Most of residents of Beringia were herbivores, says Zazula. So to understand their triumphs and tribulations, it is necessary to understand the plants they fed upon.

Because of the destructive ice sheets that periodically scoured most of the rest of North America, "there aren't too many opportunities to study the interrelationships of plants and animals in the past."

The paleoecologist confronted another challenge. "When I started examining these fossil squirrel nests and finding all these different plant remains, I suspected I could find a few papers or books that would help me find what modern ground squirrels ate."

Unfortunately, that wasn't the case.

Last summer found Zazula and his supervisor Rolf Mathewes packing shovels into an area to the east of Kluane Lake. There they unearthed nests and middens of contemporary ground squirrels.

Meanwhile, other researchers had been studying foraging patterns high in the Ruby Range, by trapping the squirrels and examining the contents of their cheek pouches.

These ground squirrels are adaptable creatures, the scientists learned. "What they're caching in the boreal forest is completely different from what they're caching in the alpine."

That adaptability may be key to why the little rodents remain with us in great

numbers while mammoths are extinct.

"If the plant communities are changing, the mammals are going to have to start responding to that," says Zazula.

The fate of popular items on the bottom of the food chain is going to reflect on the possible trials of creatures higher up, he adds. Grizzly bears, raptors, wolves and coyotes all depend in large measure on squirrel protein.

"The minute you start tinkering with one aspect of the ecosystem, the repercussions are exponential."

The Edmonton-based scientist will be returning to Dawson City for the May Gold Show to share his most recent deductions with the placer mining community.

"They've been so incredibly helpful and supportive," he says. Despite the demands of a short, intense working season, miners take time out to share their sites, finds and wisdom with scientists.

Later this summer, Zazula and his colleagues will attempt to dig even further back into the past. The Pleistocene lasted some 2.5 million years, after all.

Even with nests in hand from 80,000 years ago, researchers have just scratched the surface.

Yesterday's ground squirrels likely have much more to tell us about tomorrow.